

## IN THE CLAIMS

Please amend the claims as follows:

1-43. (canceled)

44. (currently amended) An integrated optical waveguide having an in-line light sensor integrally formed therewith, comprising:

a first part of the waveguide leading to a photodiode portion thereof;

a second part of the waveguide leading away from the photodiode portion, ~~a~~ the material from which said first and second parts of the waveguide are formed having an energy band gap ~~a~~ the magnitude of which corresponds to absorption of photons of a first wavelength, the photodiode portion comprising one or more regions of light absorbing material within the waveguide arranged to absorb a minor proportion of light of one or more selected wavelengths transmitted along the waveguide such that ~~(so~~ a major proportion of the light passes through to the second part of the waveguide ~~waveguide)~~ to thereby generate free charge carriers within the photodiode portion of the waveguide, the photodiode portion having a modification that introduces ~~being modified to introduce~~ deep band gap levels therein so as to provide at least partial absorption of photons of a selected wavelength or wavelength band greater than said first wavelength; and

detecting means for detecting the presence of said free charge carriers; and

in which the material of the waveguide and/or the dimensions thereof are selected so as to provide similar confinement factors for both the TE and TM modes whereby the detection of light thereby is substantially polarization independent.

45.-46. (canceled)

47. (currently amended) A waveguide as claimed in claim ~~46~~ 45 in which the modification includes ~~defects comprise~~ elemental impurities within ~~the photodiode portion in a crystalline structure in the photodiode portion.~~

48-50. (canceled)

51. (currently amended) A waveguide as claimed in claim ~~50~~ 44 in which the detecting means comprises a diode is p-i-n diode comprising a p-doped region, and an n-doped region in electrical contact with a nominally intrinsic region begin located so the majority of light transmitted along the waveguide passes therethrough.

52. (previously presented) A waveguide as claimed in claim 51 in which the nominally intrinsic region is relatively lightly doped with p-dopant adjacent said p-doped region and n-dopant adjacent said n-doped region.

53-54. (canceled)

55. (previously presented) A waveguide as claimed in claim 44 which is a rib waveguide comprising a rib projecting from a slab region.

56. (previously presented) A waveguide as claimed in claim 51, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p- and n-doped regions are formed on opposite sides of the rib waveguide.

57. (previously presented) A waveguide as claimed in claim 51, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p-doped region is formed on one side or both sides of the rib waveguide and the n-doped region is formed on top of the rib waveguide, or vice versa.

58. (previously presented) A waveguide as claimed in claim 56 in which the p-doped and/or n-doped regions are formed at the base of one or more recesses formed in the slab region.

59. (previously presented) A waveguide as claimed in claim 55 in which said photodiode portion is, at least partially, within the rib of the rib waveguide.

60-61. (canceled)

62. (previously presented) A waveguide as claimed in claim ~~61~~ 44 formed on a silicon-on-insulator chip.

63. (previously presented) A waveguide as claimed in claim 44 in which the selected wavelength band is around 1.3 or 1.5 microns.

64-78. (canceled)

79. (currently amended) A waveguide as claimed in claim ~~78~~ 44, where the in-line light sensor is one of a plurality of in-line light sensors included in the waveguide and in which each in-line light sensor is arranged to be sensitive to a different wavelength or wavelength band.

80-85. (canceled)

86. (new) An integrated optical waveguide having an in-line light sensor integrally formed therewith, comprising:

- a first part of the waveguide leading to a photodiode portion thereof;

- a second part of the waveguide leading away from the photodiode portion, a material from which said first and second parts of the waveguide are formed having an energy band gap a magnitude of which corresponds to absorption of photons of a first wavelength, the photodiode portion comprising one or more regions of light absorbing material within the waveguide arranged to absorb a minor proportion of light of one or more selected wavelengths transmitted along the waveguide such that a major proportion of the light passes through to the second part of the waveguide to thereby generate free charge carriers within the photodiode portion of the waveguide, the photodiode portion having a modification that introduces deep band gap levels therein so as to provide at least partial absorption of photons of a selected wavelength or wavelength band greater than said first wavelength;

- detecting means for detecting the presence of said free charge carriers; and

- a wavelength selective reflector means being arranged to reflect light of said selected wavelength or range of wavelengths so it passes repeatedly through the photodiode.

87. (new) A waveguide as claimed in claim 86 in which the modification includes elemental impurities in a crystalline structure in the photodiode portion.

88. (new) A waveguide as claimed in claim 86 in which the detecting means comprises a p-i-n diode comprising a p-doped region, and an n-doped region in electrical contact with a nominally intrinsic region begin located so the majority of light transmitted along the waveguide passes therethrough.

89. (new) A waveguide as claimed in claim 88 in which the nominally intrinsic region is relatively lightly doped with p-dopant adjacent said p-doped region and n-dopant adjacent said n-doped region.

90. (new) A waveguide as claimed in claim 86 which is a rib waveguide comprising a rib projecting from a slab region.

91. (new) A waveguide as claimed in claim 88, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p- and n-doped regions are formed on opposite sides of the rib waveguide.

92. (new) A waveguide as claimed in claim 88, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p-doped region is formed on one side or both sides of the rib waveguide and the n-doped region is formed on top of the rib waveguide, or vice versa.

93. (new) A waveguide as claimed in claim 91 in which the p-doped and/or n-doped regions are formed at the base of one or more recesses formed in the slab region.

94. (new) A waveguide as claimed in claim 90 in which said photodiode portion is, at least partially, within the rib of the rib waveguide.

95. (new) A waveguide as claimed in claim 86 formed on a silicon-on-insulator chip.
96. (new) A waveguide as claimed in claim 86 in which the selected wavelength band is around 1.3 or 1.5 microns.
97. (new) A waveguide as claimed in claim 86 in which the reflective means comprises first and second reflectors.
98. (new) A waveguide as claimed in claim 97 in which the first and second reflectors are provided in the first and second parts of the waveguide on opposite sides of the diode portion.
99. (new) A waveguide as claimed in claim 97 in which at least one of the first and second reflectors comprises a Bragg grating.
100. (new) A waveguide as claimed in claim 86 in which the in-line light sensor is tunable so as to be sensitive to one or more selected wavelengths or wavelength bands.
101. (new) A waveguide as claimed in claim 100 in which first wavelength control means are provided to adjust the wavelength or band of wavelengths reflected by the reflector means.
102. (new) A waveguide as claimed in claim 100 in which second wavelength control means are provided to adjust the wavelength or band of wavelengths absorbed within the diode portion.
103. (new) A waveguide as claimed in claim 100 in which the in-line light sensor can be scanned over a range of wavelengths to provide a spectral analysis of the light received.
104. (new) A waveguide as claimed in claim 86 where the in-line light sensor is one of a plurality of in-line light sensors included in the waveguide and each in-line light sensor is arranged to be sensitive to a different wavelength or wavelength band.

105. (new) An integrated optical waveguide having an in-line light sensor integrally formed therewith, comprising:

a first part of the waveguide leading to a photodiode portion thereof;

a second part of the waveguide leading away from the photodiode portion, a material from which said first and second parts of the waveguide are formed having an energy band gap a magnitude of which corresponds to absorption of photons of a first wavelength, the photodiode portion comprising one or more regions of light absorbing material within the waveguide arranged to absorb a minor proportion of light of one or more selected wavelengths transmitted along the waveguide such that a major proportion of the light passes through to the second part of the waveguide to thereby generate free charge carriers within the photodiode portion of the waveguide, the photodiode portion having a modification that introduces deep band gap levels therein so as to provide at least partial absorption of photons of a selected wavelength or wavelength band greater than said first wavelength;

detecting means for detecting the presence of said free charge carriers; and

an optical attenuator for attenuating the light passing through the in-line light sensor, wherein said attenuator is a variable optical attenuator.

106. (new) A waveguide as claimed in claim 105 in which the modification includes elemental impurities in a crystalline structure in the photodiode portion.

107. (new) A waveguide as claimed in claim 105 in which the detecting means comprises a p-i-n diode comprising a p-doped region, and an n-doped region in electrical contact with a nominally intrinsic region begin located so the majority of light transmitted along the waveguide passes therethrough.

108. (new) A waveguide as claimed in claim 107 in which the nominally intrinsic region is relatively lightly doped with p-dopant adjacent said p-doped region and n-dopant adjacent said n-doped region.

109. (new) A waveguide as claimed in claim 105 which is a rib waveguide comprising a rib projecting from a slab region.

110. (new) A waveguide as claimed in claim 107, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p- and n-doped regions are formed on opposite sides of the rib waveguide.

111. (new) A waveguide as claimed in claim 107, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p-doped region is formed on one side or both sides of the rib waveguide and the n-doped region is formed on top of the rib waveguide, or vice versa.

112. (new) A waveguide as claimed in claim 110 in which the p-doped and/or n-doped regions are formed at the base of one or more recesses formed in the slab region.

113. (new) A waveguide as claimed in claim 109 in which said photodiode portion is, at least partially, within the rib of the rib waveguide.

114. (new) A waveguide as claimed in claim 105 formed on a silicon-on-insulator chip.

115. (new) A waveguide as claimed in claim 105 in which the selected wavelength band is around 1.3 or 1.5 microns.

116. (new) A waveguide as claimed in claim 105 where the in-line light sensor is one of a plurality of in-line light sensors included in the waveguide and each in-line light sensor is arranged to be sensitive to a different wavelength or wavelength band.

117. (new) A waveguide as claimed in claim 116 in which the in-line light sensors are arranged in series along a serpentine light conductive path.

118. (new) A waveguide as claimed in claim 117 formed on a substrate, said substrate having optical and/or electrical isolation devices formed therein positioned so as to assist in optically

and/or electrically isolating different portions of said serpentine path from each other.

119. (new) An integrated optical waveguide having an in-line light sensor integrally formed therewith, comprising:

- a first part of the waveguide leading to a photodiode portion thereof;

- a second part of the waveguide leading away from the photodiode portion, a material from which said first and second parts of the waveguide are formed having an energy band gap a magnitude of which corresponds to absorption of photons of a first wavelength, the photodiode portion comprising one or more regions of light absorbing material within the waveguide arranged to absorb a minor proportion of light of one or more selected wavelengths transmitted along the waveguide such that a major proportion of the light passes through to the second part of the waveguide to thereby generate free charge carriers within the photodiode portion of the waveguide, the photodiode portion having a modification that introduces deep band gap levels therein so as to provide at least partial absorption of photons of a selected wavelength or wavelength band greater than said first wavelength;

- detecting means for detecting the presence of said free charge carriers; and

- two or more in-line light sensors arranged in series along a serpentine light conductive path.

120. (new) A waveguide as claimed in claim 119 in which the modification includes elemental impurities in a crystalline structure in the photodiode portion.

121. (new) A waveguide as claimed in claim 119 in which the detecting means comprises a p-i-n diode comprising a p-doped region, and an n-doped region in electrical contact with a nominally intrinsic region begin located so the majority of light transmitted along the waveguide passes therethrough.

122. (new) A waveguide as claimed in claim 121 in which the nominally intrinsic region is relatively lightly doped with p-dopant adjacent said p-doped region and n-dopant adjacent said n-doped region.



123. (new) A waveguide as claimed in claim 119 which is a rib waveguide comprising a rib projecting from a slab region.

124. (new) A waveguide as claimed in claim 119, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p- and n-doped regions are formed on opposite sides of the rib waveguide.

125. (new) A waveguide as claimed in claim 119, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p-doped region is formed on one side or both sides of the rib waveguide and the n-doped region is formed on top of the rib waveguide, or vice versa.

126. (new) A waveguide as claimed in claim 124 in which the p-doped and/or n-doped regions are formed at the base of one or more recesses formed in the slab region.

127. (new) A waveguide as claimed in claim 126 in which said photodiode portion is, at least partially, within the rib of the rib waveguide.

128. (new) A waveguide as claimed in claim 119 formed on a silicon-on-insulator chip.

129. (new) A waveguide as claimed in claim 119 in which the selected wavelength band is around 1.3 or 1.5 microns.

130. (new) A waveguide as claimed in claim 119 in which each in-line light sensor is arranged to be sensitive to a different wavelength or wavelength band.

131. (new) A waveguide as claimed in claim 119 formed on a substrate, said substrate having optical and/or electrical isolation devices formed therein positioned so as to assist in optically and/or electrically isolating different portions of said serpentine path from each other.

132. (new) A waveguide as claimed in claim 119 in which each of the in-line light sensors has a

variable optical attenuator in series therewith.

133. (new) An integrated optical waveguide having an in-line light sensor integrally formed therewith, comprising:

- a first part of the waveguide leading to a photodiode portion thereof;

- a second part of the waveguide leading away from the photodiode portion, a material from which said first and second parts of the waveguide are formed having an energy band gap a magnitude of which corresponds to absorption of photons of a first wavelength, the photodiode portion comprising one or more regions of light absorbing material within the waveguide arranged to absorb a minor proportion of light of one or more selected wavelengths transmitted along the waveguide such that a major proportion of the light passes through to the second part of the waveguide to thereby generate free charge carriers within the photodiode portion of the waveguide, the photodiode portion having a modification that introduces deep band gap levels therein so as to provide at least partial absorption of photons of a selected wavelength or wavelength band greater than said first wavelength; detecting means for detecting the presence of said free charge carriers; and

- the in-line light sensor is one of a plurality of in-line light sensors included in the waveguide, the in-line light sensors arranged in series or in parallel, and each light sensor having a variable optical attenuator in series therewith.

134. (new) A waveguide as claimed in claim 133 in which the modification includes elemental impurities in a crystalline structure in the photodiode portion.

135. (new) A waveguide as claimed in claim 133 in which the detecting means comprises a p-i-n diode comprising a p-doped region, and an n-doped region in electrical contact with a nominally intrinsic region begin located so the majority of light transmitted along the waveguide passes therethrough.

136. (new) A waveguide as claimed in claim 135 in which the nominally intrinsic region is relatively lightly doped with p-dopant adjacent said p-doped region and n-dopant adjacent said n-doped region.

137. (new) A waveguide as claimed in claim 133 in which is a rib waveguide comprising a rib projecting from a slab region.

138. (new) A waveguide as claimed in claim 134, wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p- and n-doped regions are formed on opposite sides of the rib waveguide.

139. (new) A waveguide as claimed in claim 134 wherein the waveguide is a rib waveguide comprising a rib projecting from a slab region, and wherein the p-doped region is formed on one side or both sides of the rib waveguide and the n-doped region is formed on top of the rib waveguide, or vice versa.

140. (new) A waveguide as claimed in claim 138 in which the p-doped and/or n-doped regions are formed at the base of one or more recesses formed in the slab region.

141. (new) A waveguide as claimed in claim 140 in which said photodiode portion is, at least partially, within the rib of the rib waveguide.

142. (new) A waveguide as claimed in claim 133 formed on a silicon-on-insulator chip.

143. (new) A waveguide as claimed in claim 133 in which the selected wavelength band is around 1.3 or 1.5 microns.